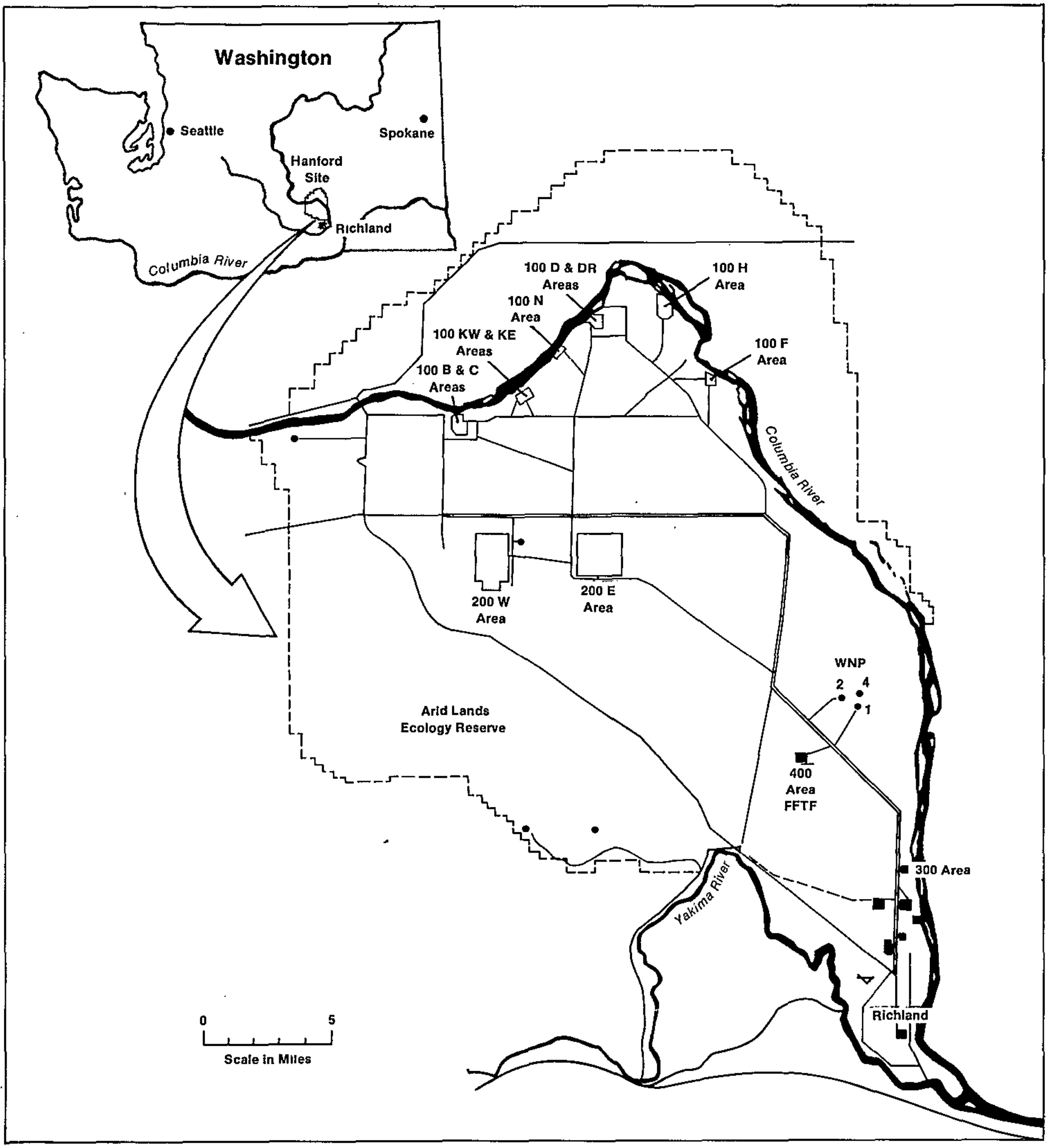
DOE/RL 88-13

Implementation Plan for the Record of Decision for Disposal of Hanford Defense High-Level, Transuranic, and Tank Wastes

United States
Department of Energy
Richland, Washington

Hanford Site



The 560-square-mile Hanford site is located in south central Washington State where the climate is semiarid. Except for one small site near the Washington Public Power Supply System Nuclear Project No. 2 (WNP-2), the waste considered in the "Final Environmental Impact Statement, Disposal of Hanford Defense High-Level, Transuranic and Tank Wastes" is contained in the central plateau at least 140 feet above the water table and at least 5 miles from the Columbia River.

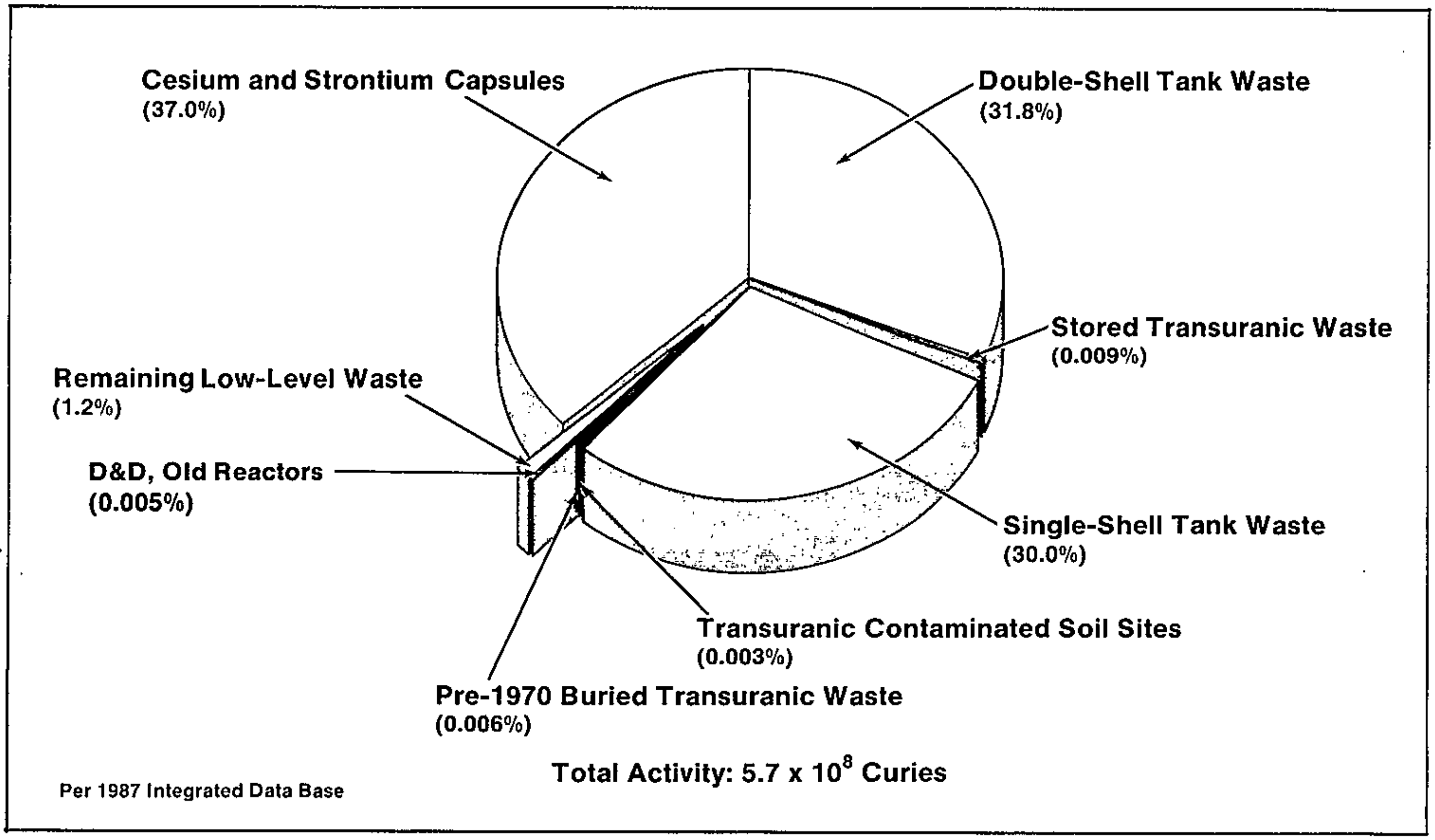
Summary

This plan outlines the steps necessary to implement the Record of Decision, published in the Federal Register in April 1988, for the *Final Environmental Impact Statement, Disposal of Hanford Defense High-Level, Transuranic and Tank Wastes* (HDW-EIS). The Record of Decision concludes one phase and initiates another leading to the disposal of two thirds (by radioactivity) of the defense waste at Hanford. It also commits to continuing evaluations for most of the remaining one third before final disposal or remediation decisions are made.

Disposal alternatives were presented earlier for public comment. The comments were reviewed and a preferred disposal alternative was developed. The U.S. Department of Energy (DOE) has decided to implement the preferred alternative, which was presented in the Final HDW-EIS. The preferred alternative recommends disposal of double-shell tank waste, retrievably stored and newly generated transuranic waste, and encapsulated cesium and strontium waste. Also to be disposed of is the only solid waste site from before 1970 suspected of being contaminated with transuranic elements and not on Hanford's central plateau. This site is near the commercial nuclear power plant operated by the Washington Public Power Supply System (WNP-2).

The preferred alternative also recommends additional technology be developed and evaluations

Radioactivity of Hanford Defense Wastes



In considering the risks to the public, the workers and future populations, it is the radioactivity associated with the Hanford defense waste that is of primary concern. Risks associated with hazardous chemicals also will be considered. The Record of Decision provides for geologic disposal of 69% of the radioactivity (cesium and strontium capsules, double-shell tank waste, and stored transuranic waste). The Record of Decision also provides for continuing development and evaluation efforts for most of the remaining 31% (single-shell tank waste, transuranic contaminated soil sites, and pre-1970 buried transuranic waste) before final disposal decisions are made.

done before a final disposal decision is made on the other defense wastes addressed in the HDW-EIS. These include: single-shell tank waste, transuranic-contaminated soil sites, and pre-1970 buried suspect transuranic-contaminated solid waste sites.

Disposal costs stated in this plan, including costs for construction of disposal facilities, are taken from the HDW-EIS. Schedules for disposal activities are from the Hanford Waste Management Plan (DOE/RL 87-13). Schedules for development and evaluation activities are from the Hanford Waste Management Technology Plan (DOE/RL 87-14). Estimated costs and schedules are subject to change as activities proceed, implementing requirements of environmental regulations are further defined, more detailed studies are performed, policy decisions are made affecting work scope (e.g., the decision to place N Reactor in cold standby), and funding levels are defined through the Federal budgeting process. The Hanford Waste Management Plan and the Hanford Waste Management Technology Plan are revised annually to provide updated information on costs and schedules for disposal and development activities. These or their successors should be referred to for current information on disposal plans, costs, and schedules.

Disposal operations will be conducted in compliance with all applicable environmental regulations, standards, and permit requirements.

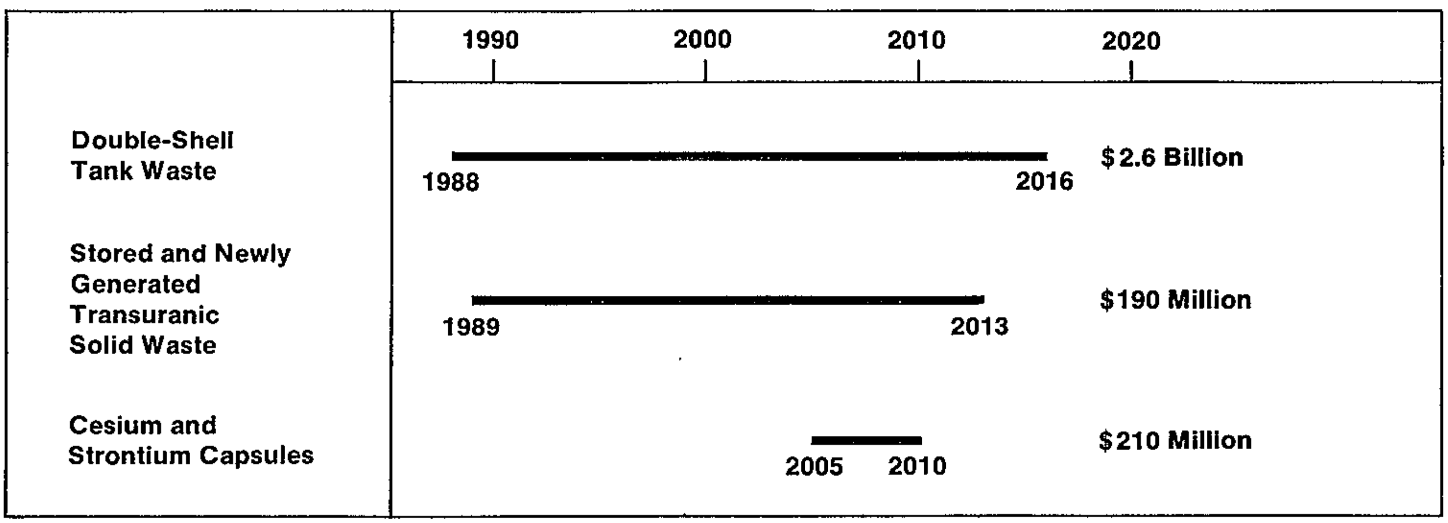
Disposal Actions

Double-shell tank waste: High-level radioactive waste stored in double-shell tanks will be processed into a solid vitrified material similar to glass at a new facility yet to be built—the Hanford Waste Vitrification Plant—and then disposed of in a geologic repository. Low-level radioactive tank wastes will be mixed with a cement-like material and allowed to harden in near-surface concrete vaults on site. The vaults will be covered with a protective barrier and marker system to deter water, plant, animal and human intrusion. Disposal should be completed by the year 2016.

Stored solid transuranic waste: Most of this waste is now stored in steel drums or special boxes under several feet of soil. This waste will be packaged at the Waste Receiving and Processing Facility yet to be built, and sent to the Waste Isolation Pilot Plant (WIPP) in New Mexico for geologic disposal. The WIPP is a repository designated for defense transuranic waste disposal. Some of the transuranic solid waste generated since 1985 is stored in an aboveground facility, and will be sent directly to WIPP for disposal. Disposal of retrievably stored and newly generated transuranic waste should be completed by the year 2013.

Cesium and strontium capsules: Cesium and strontium were previously chemically separated from single-shell tank waste and placed in capsules. Many of the cesium capsules are currently leased for medical applications and industrial use. The cesium and strontium capsules will eventually be disposed of in a geologic repository. Disposal should be completed by the year 2010.

Disposal Cost and Schedule

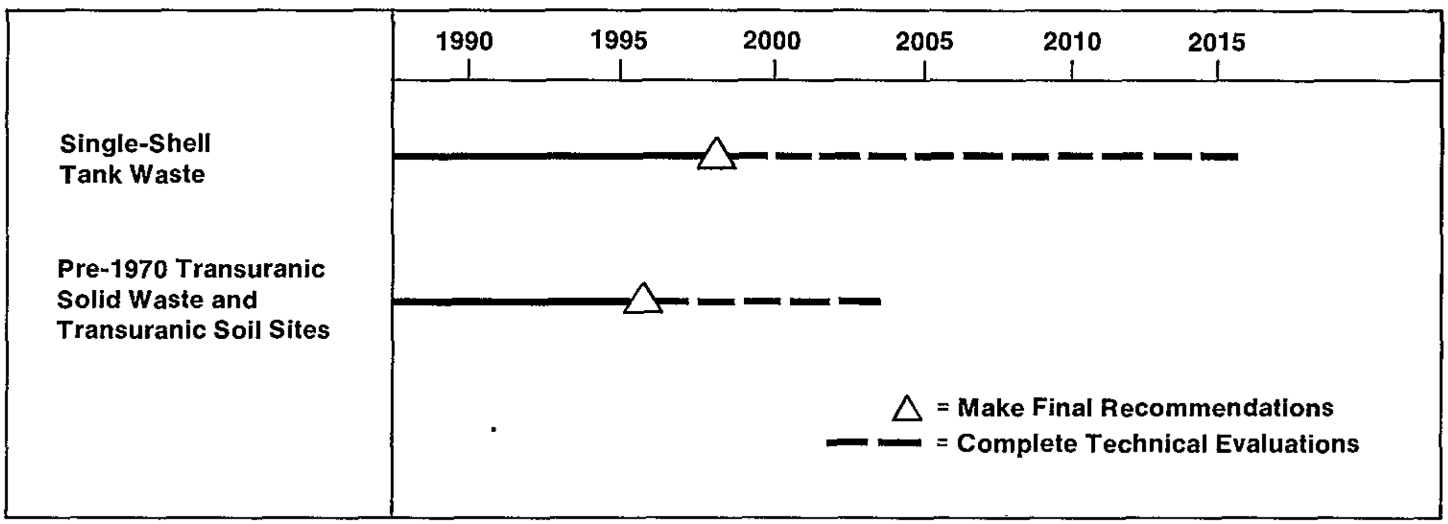


Summary of cost and schedule to dispose of double-shell tank waste, stored and newly generated transuranic solid waste, and encapsulated cesium and strontium waste. Schedules shown are for actual disposal operations. Estimated costs are from the HDW-EIS and include development of disposal technology, disposal operations, and capital costs associated with disposal. Estimated costs and schedules are updated annually in Department of Energy waste management plans.

Additional Development and Evaluation

For single-shell tank wastes, technology development and evaluation activities have been identified that will support a recommendation on method of disposal in about 10 years. Similar development and evaluation work for transuranic-contaminated soil sites and transuranic solid wastes buried before 1970 will be performed in concert with other site environmental remediation activities, under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA—or "Superfund"). Development and evaluation will support recommendations on remedial action as early as the mid 1990's. Characterization and remedial actions for individual sites will be done on a priority basis. The priority ranking will be based on comments from governmental agencies and the public, and is expected to be completed by the end of 1989. The activities presently identified for development and evaluation for single-shell tank wastes and transuranic-contaminated sites are described later in this plan. For these waste types, recommendations on remedial action and disposal will be submitted for review by governmental agencies and the public prior to completion of all development and evaluation activities. The development and evaluation will continue until about the year 2015 for single-shell tanks, and until about 2004 for the transuranic contaminated sites, to support final disposal actions.

Development and Evaluation Schedule



Schedule to conduct development and evaluation activities. Enough information will be available to develop final disposal recommendations for public and governmental agency review beginning in the mid to late 1990's. Detailed characterization, analysis, and development will then continue as necessary to support final disposal actions. Schedules for development and evaluation are updated annually in Department of Energy waste management plans.

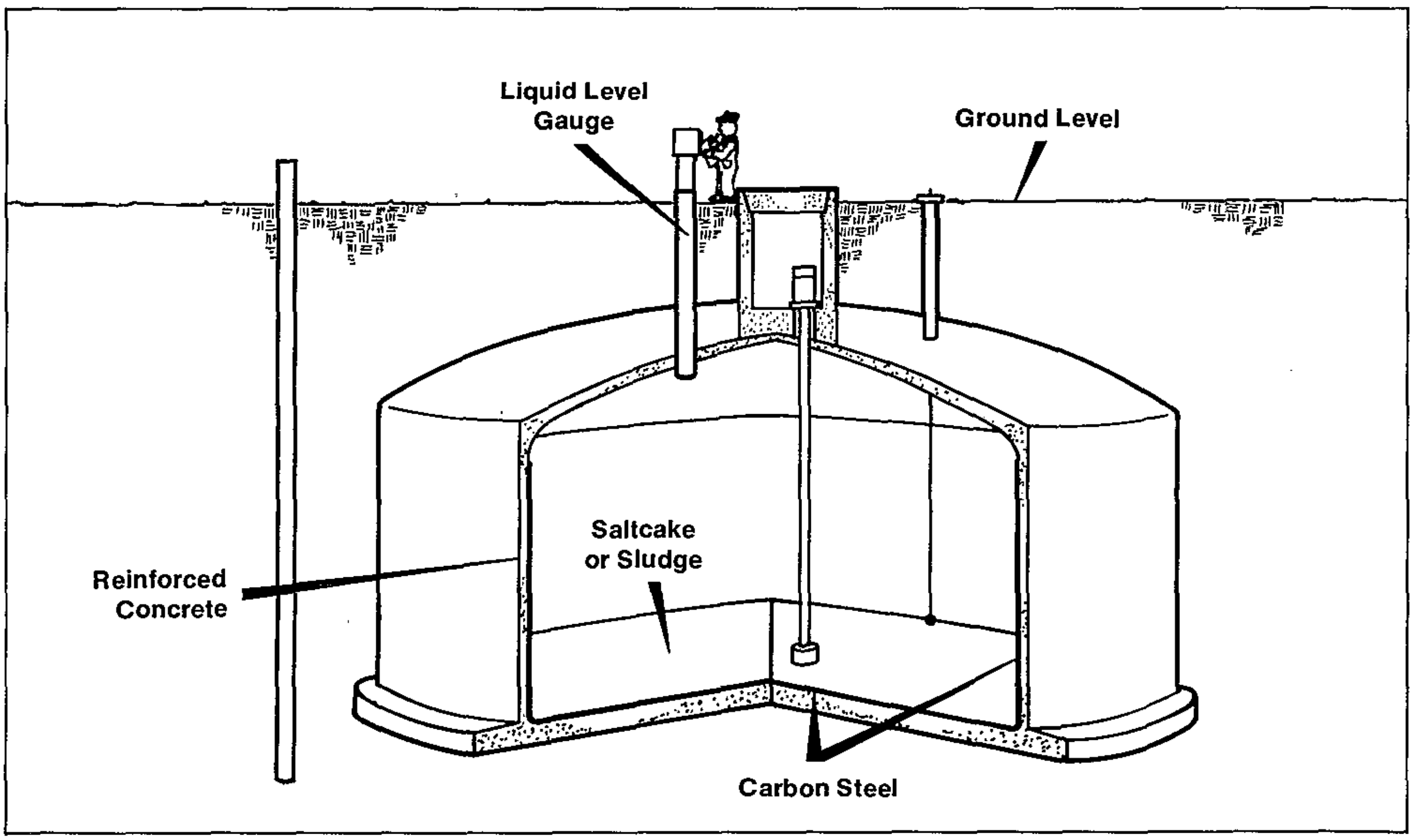
Background

Hanford's defense production mission has resulted in different waste types. These include: single-shell and double-shell tank wastes in the form of sludge, slurry, saltcake and liquid; encapsulated cesium and strontium waste; solid wastes in drums, burial boxes and trenches; and soils and sediments contaminated by disposal of liquid wastes in ponds, ditches, cribs (similar to septic tank drain fields) and other drainage devices.

The HDW-EIS considers high-level, transuranic and tank wastes. Tank wastes result from various processing activities and may be either high-level, transuranic, low-level or hazardous chemical wastes. Also considered are low-level wastes that result from processing wastes for final disposal.

The 149 single-shell tanks store 37 million gallons of solids and residual liquids. Most of the liquid wastes originally contained in single-shell tanks was concentrated by evaporation and pumped to double-shell tanks. Wastes from processing operations have not been added to single-shell tanks since November 1980. These tanks are made of reinforced concrete with a single carbon steel liner. Not quite one-half of the tanks have, or are suspected of having, leaked some of their contents to the surrounding soil.

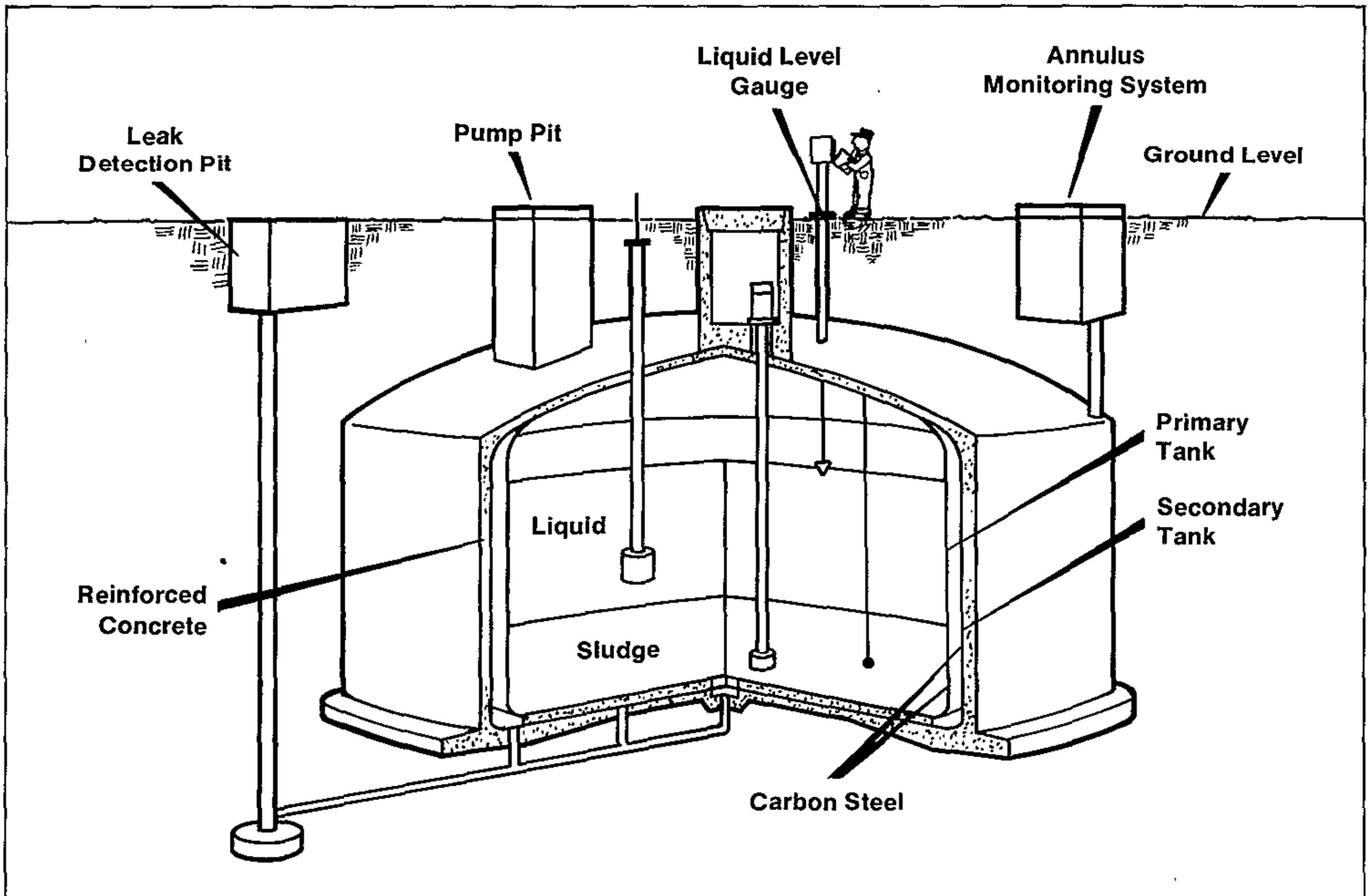
Past Operations - Single-Shell Tank



At Hanford 149 single-shell tanks contain 37 million gallons of waste in the form of sludge and saltcake with small amounts of liquid. Active use of these tanks was discontinued in 1980.

The 28 double-shell tanks store 17 million gallons of radioactive liquid and slurry, much of which has been transferred and concentrated from single-shell tanks. Double-shell tanks have been used since 1971, and used exclusively since 1980 when single-shell tanks were retired from service. Additional waste will be generated from future processing operations.

Typical Double-Shell Tank

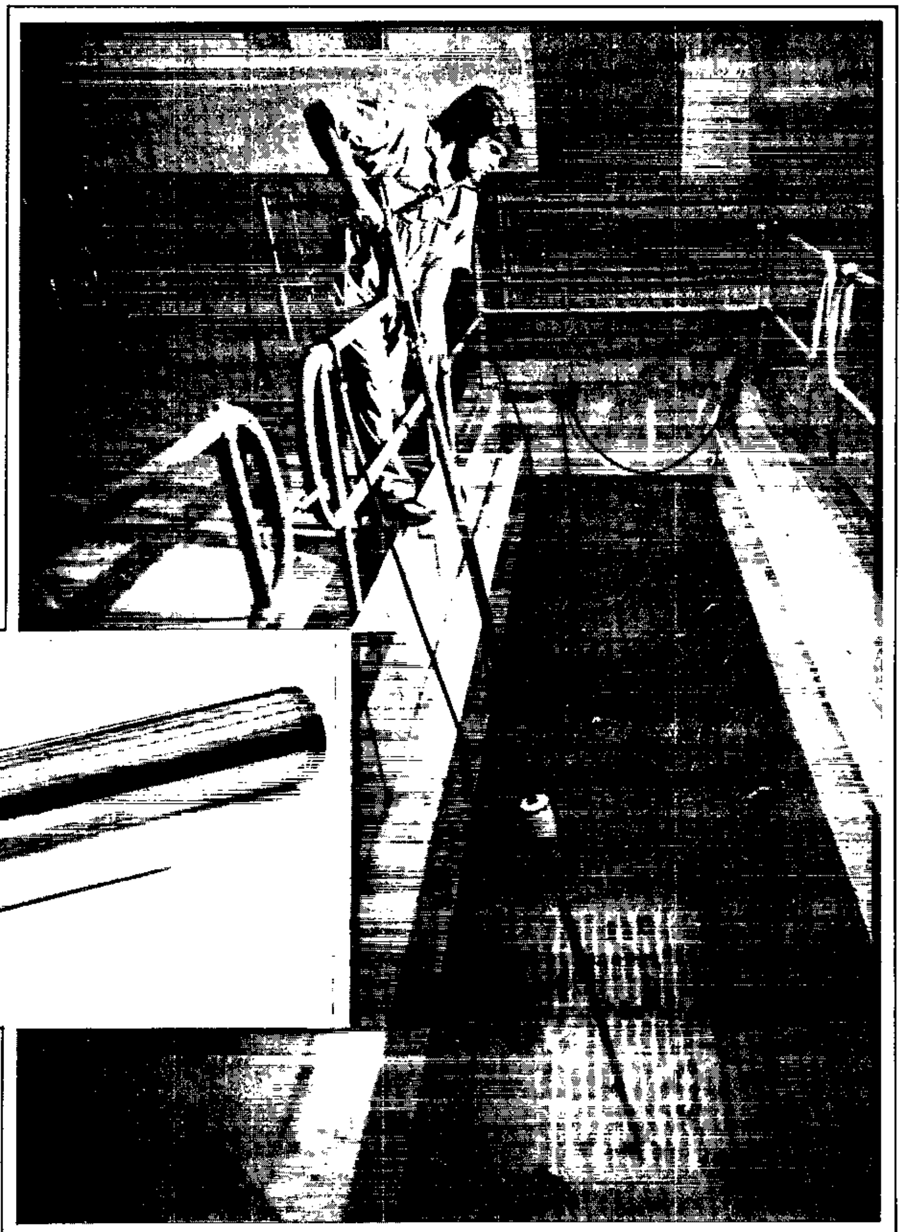


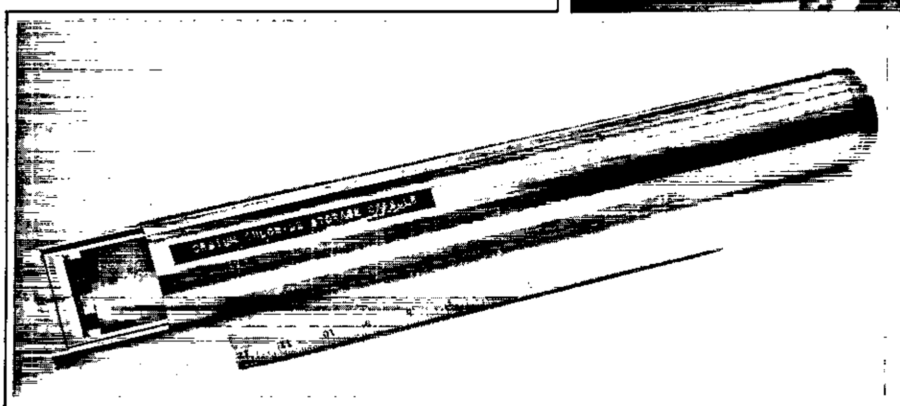
Twenty-eight double-shell tanks contain 17 million gallons of waste. Most is in a readily recoverable slurry. They were first put in use in 1971.

Background (continued)

Much of the cesium and strontium was removed from single-shell tank waste to reduce heat-generation and was solidified and sealed in double-walled, metal capsules. The 1,576 cesium capsules and 640 strontium capsules are now stored in water basins or leased for beneficial use.

Capsules



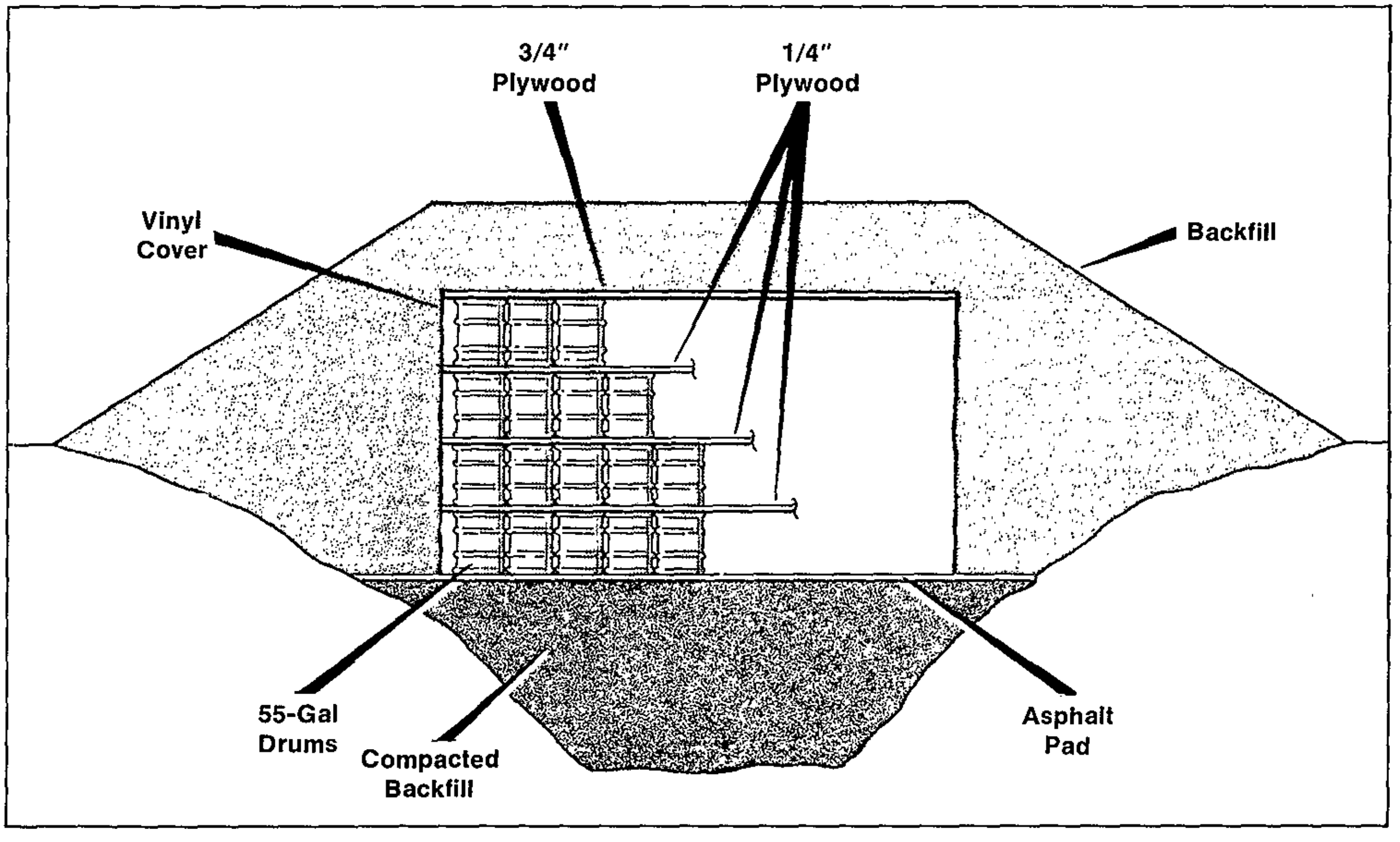


Doubly encapsulated waste containing strontium and cesium are stored in water basins. There are 640 strontium capsules and 1576 cesium capsules. Nearly half of the cesium capsules have been leased to serve as radiation sources for medical and industrial applications.

Transuranic solid waste generated since 1970 is being stored in drums and boxes awaiting treatment for disposal at the Waste Isolation Pilot Plant (WIPP) in New Mexico. This solid waste has been stored in retrievable containers, and about 19,000 cubic yards has accumulated since 1970. This includes 30 cubic yards of waste stored in underground structures called caissons. Additional transuranic solid waste will be generated from future processing operations and certified for disposal at WIPP. Some of this newly generated waste will require treatment in the Waste Receiving and Processing Facility (yet to be constructed) before it can be certified to meet the WIPP waste acceptance criteria.

Some solid waste generated before 1970 is suspected of being contaminated with transuranic elements. This solid waste consists of trash and failed equipment disposed of in nine soil-covered trenches.

Retrievably Stored Transuranic Waste

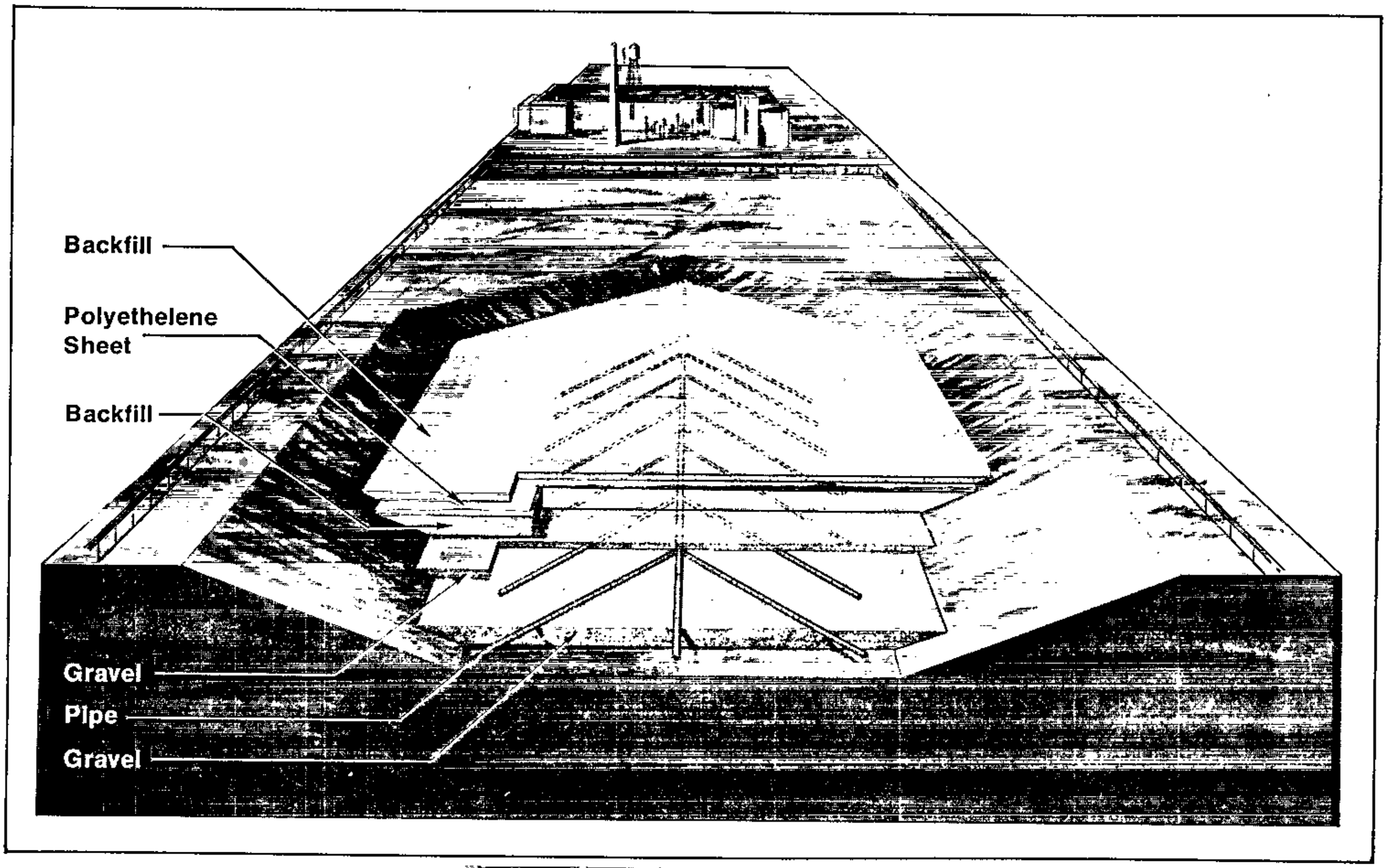


Most of the retrievably stored transuranic solid waste is contained in metal boxes and 55-gallon drums placed on asphalt pads. Trenches used before 1970 that contain buried suspect transuranic-contaminated and low-level solid waste are similar to trenches shown here but do not contain an asphalt pad, and are completely below the natural ground level. When filled, these trenches are covered with soil.

Background (continued)

Transuranic-contaminated soil sites were contaminated by disposal of liquid wastes emptying into cribs, ditches, trenches, settling tanks, reverse wells, ponds, and drains. These practices were discontinued in the early 1970's. Twenty-four soil sites are suspected of having transuranic contamination.

Crib Construction Details



The crib shown here typifies contaminated soil sites. These are being phased out. There are 24 of these sites which are suspected of containing transuranic waste.

Details of the Decision and Its Implementation

Many alternatives were considered for disposing of Hanford's high-level, transuranic, and tank wastes. The three alternatives evaluated in the Draft HDW-EIS were geologic disposal of 98 percent (by radioactivity) of the wastes, in-place stabilization and disposal of all wastes, and a reference alternative that combined the features of both. In addition, a no disposal action alternative—continuing present storage practices—was analyzed in accordance with regulations.

The preferred alternative, presented in the Final HDW-EIS, was developed based on technical analyses under the direction of DOE, and comments from governmental agencies and the public. It recommended disposal actions described in the reference alternative for some of the wastes and additional development and evaluation for the rest. DOE has decided to implement the preferred alternative, described as follows.

Existing and future double-shell tank waste will be pretreated if necessary. The high-level portion will be processed in the Hanford Waste Vitrification Plant (HWVP) which will solidify it for disposal in a geologic repository. The remaining low-level portion will be mixed with grout in the Grout Treatment Facility and disposed of in near-surface concrete vaults.

Stored transuranic-contaminated solid waste will be disposed of at the Waste Isolation Pilot Plant in New Mexico after being retrieved and processed (if necessary) in the Waste Receiving and Processing Facility.

Encapsulated strontium and cesium waste will be disposed of in a geologic repository. The waste packaging design will meet repository waste acceptance criteria. Until disposal, the capsules will be either maintained in monitored water basins at Hanford or leased for beneficial use.

Development and evaluation will be continued on three waste types to support final disposal decisions. These types are single-shell tank waste, pre-1970 buried suspect transuranic-contaminated solid waste, and transuranic-contaminated soil sites. The one exception is that DOE will proceed with exhuming and processing the only pre-1970 buried suspect transuranic-contaminated solid waste site that is not on the central plateau (located near the WNP-2 Nuclear Power Plant operated by the Washington Public Power Supply System). Disposal of these waste types is no less important than disposal of the first three. However, the consensus focused on taking action on wastes that could be most readily disposed of, particularly liquid waste, and continuing evaluations for the other wastes. Safe storage will be maintained during the evaluation period.

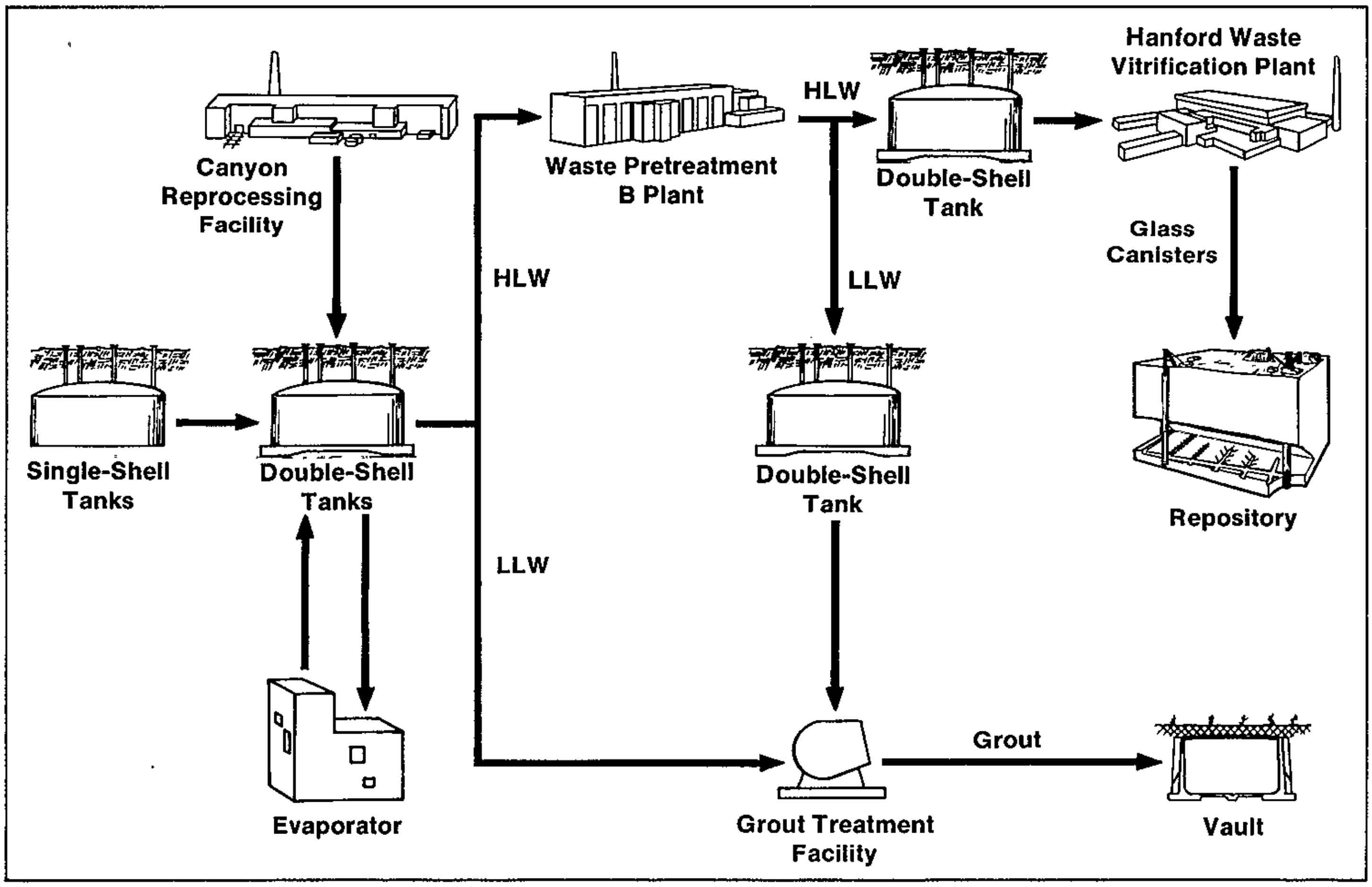
As a result of these decisions, plans are being developed to implement the above actions.

Double-Shell Tank Waste

Double-shell tank waste will be separated into two portions as necessary. The high-level portion will be converted to vitrified glass in a facility called the Hanford Waste Vitrification Plant (HWVP) and sent to a geologic repository. The low-level portion will be solidified in cement-based grout and disposed of in near-surface vaults. This will take place at the Grout Treatment Facility.

The process for separating the high- and low-level waste portions is an important design step now being finalized. Separation is envisioned to take place in an existing facility called B Plant. The equipment inside the facility is being upgraded to incorporate this separation process. Different types of wastes have been stored in the double-shell tanks because of the different types of processing activities at Hanford. Some may require no pretreatment. Others may require various types of treatment in order to assure optimum separation of the high-level portion from the low-level portion of the particular waste.

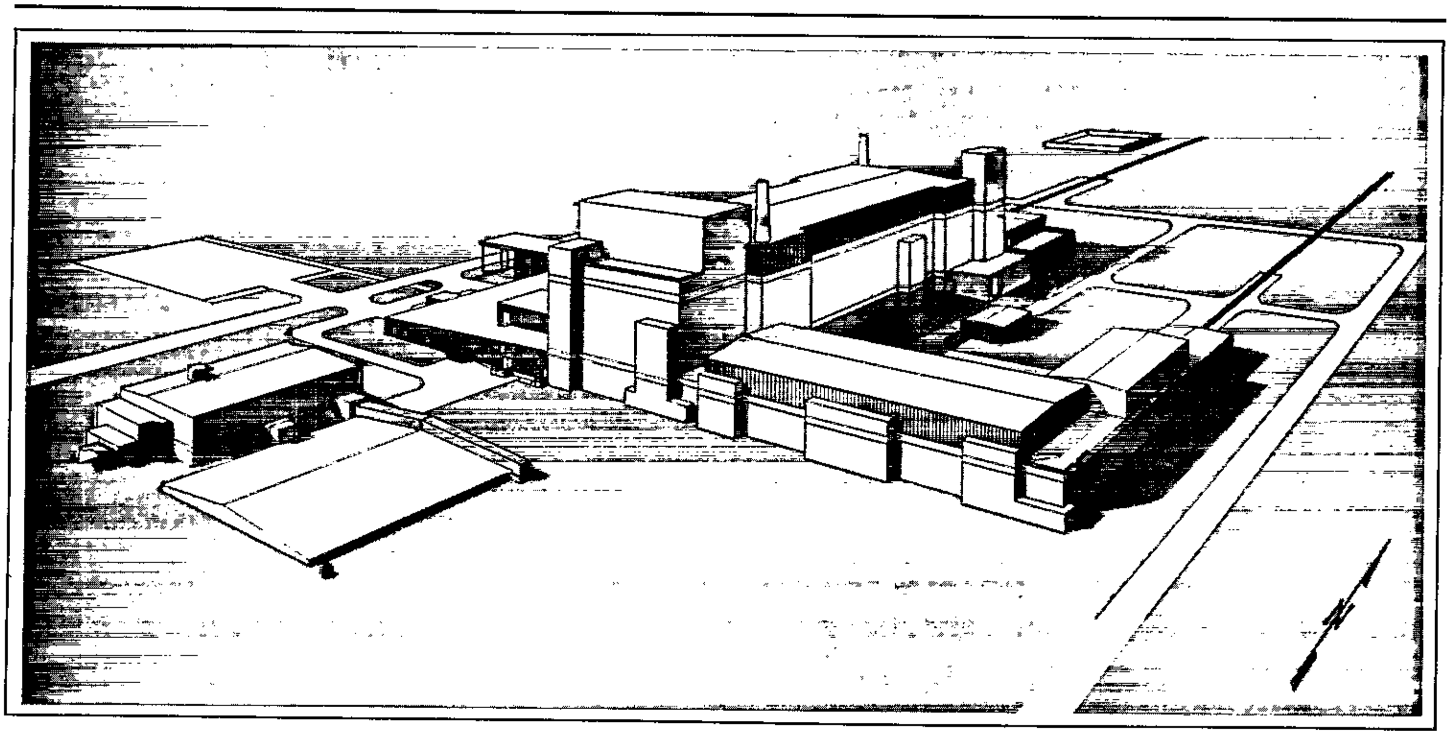
Double-Shell Tank Waste Disposal



For double-shell tank waste, the DOE has decided to initiate disposal. To accomplish this, the DOE will design, construct, and operate the Hanford Waste Vitrification Plant (HWVP). The high-level waste portion will be processed into a vitrified solid waste form and stored at the HWVP until a geologic repository is ready to receive this waste. The low-level portion will be solidified as a cement-based grout and disposed of near surface.

The HWVP is a major facility that is estimated to cost in excess of $1.2 billion, including $920 million for design and construction. Preliminary design is presently underway and construction is planned for the mid 1990's with start-up in 1999. Engineers are working closely with the geologic repository program to ensure that the waste form produced will meet all repository requirements. Pilot-scale tests have ensured that the melter, which produces a molten homogenous mixture of glass-forming material and waste, will work successfully on the Hanford waste. The plant design is based on a similar plant under construction at Savannah River, South Carolina. Also, information is being gathered from another plant being designed at West Valley, New York, as well as plants either in design or under testing in both France and Germany. At certain stages of design and construction, analyses will be performed to assure that the impacts of HWVP construction and operation are not significantly greater than those presented in the HDW-EIS, and to determine if additional environmental documentation will be required. Also, permit applications to construct and operate HWVP will be submitted to the State of Washington and the U.S. Environmental Protection Agency. State-of-the-art designs for the melter, the processing equipment, instrumentation, and filtration system will be used in this facility. The HWVP will produce approximately 2000 glass canisters from the double-shell tank waste through the year 2014. After a period of storage, these canisters will be shipped to the nation's geologic repository. The period of storage depends on the availability of the repository to receive waste shipments from Hanford.

Hanford Waste Vitrification Plant



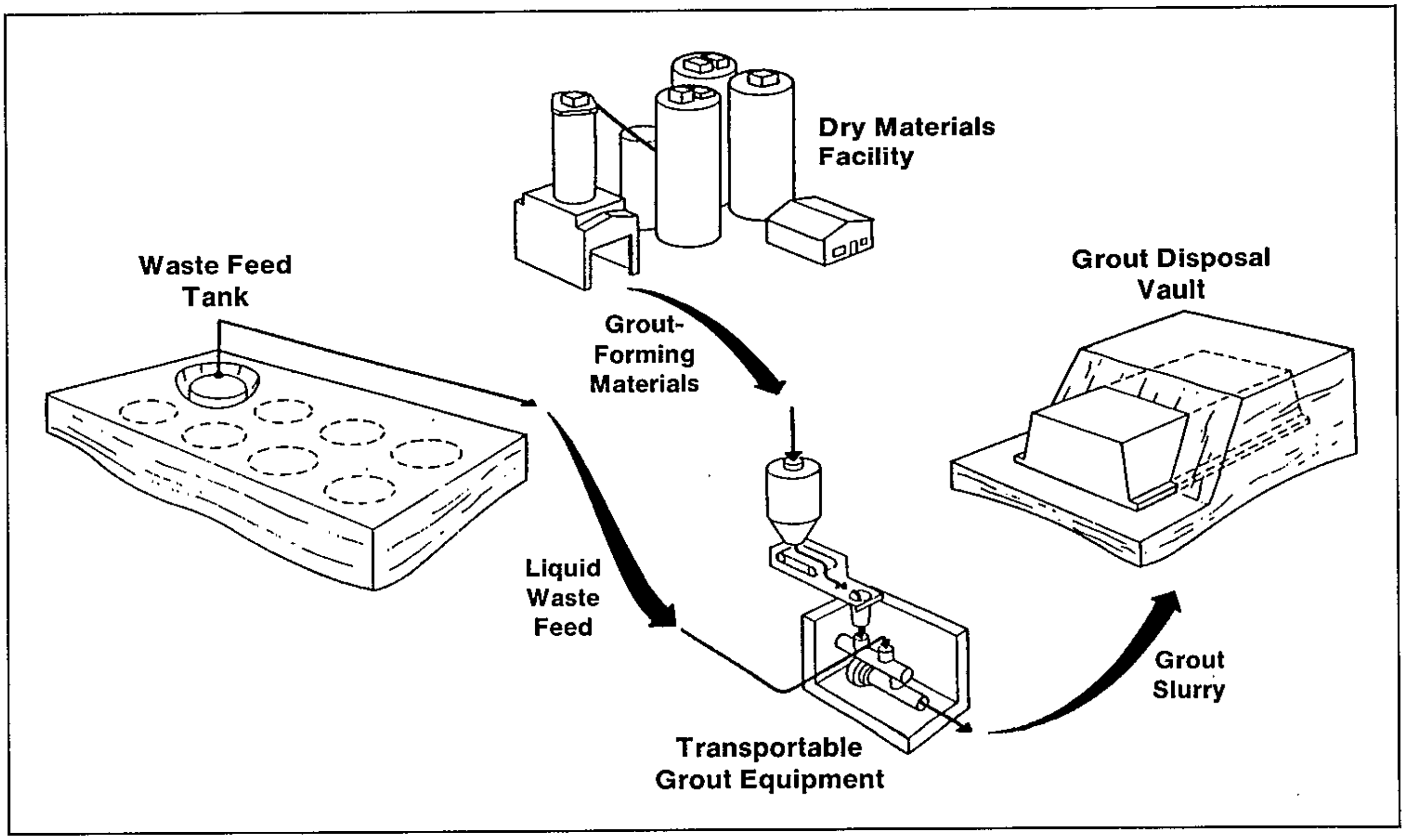
This is a conceptual view of the Hanford Waste Vitrification Plant which will vitrify high-level waste for geologic repository disposal. The total cost of this facility is estimated at $1.2 billion. It is scheduled to operate from 1999 through 2014 on the high-level portion of double-shell tank waste.

Double-Shell Tank Waste (continued)

The low-level portion, as discussed earlier, will be solidified into a cement-like material. Similar technology has been used in other industries throughout the world as a method for solidifying hazardous or radioactive liquid waste. At Hanford, this technology will be applied on a much larger scale. A number of studies and tests will be done to ensure the process is effective. Before grouting the low-level portion of double-shell tank waste, a full-scale test of the Grout Treatment Facility is planned to start in the summer of 1988. This facility consists of several parts. A Dry Materials Facility will blend commercially produced cement-based materials. Completed in 1986, the facility will blend cement, fly ash, blast furnace slag and clays.

The dry blend will be hauled in trucks to the Transportable Grout Equipment, where it will be mixed with the liquid waste to form a slurry. The Transportable Grout Equipment was completed in 1988. The slurry will be pumped to large underground concrete vaults, where it will harden. Each vault is over one million gallons in capacity and approximately 60 vaults will eventually be needed.

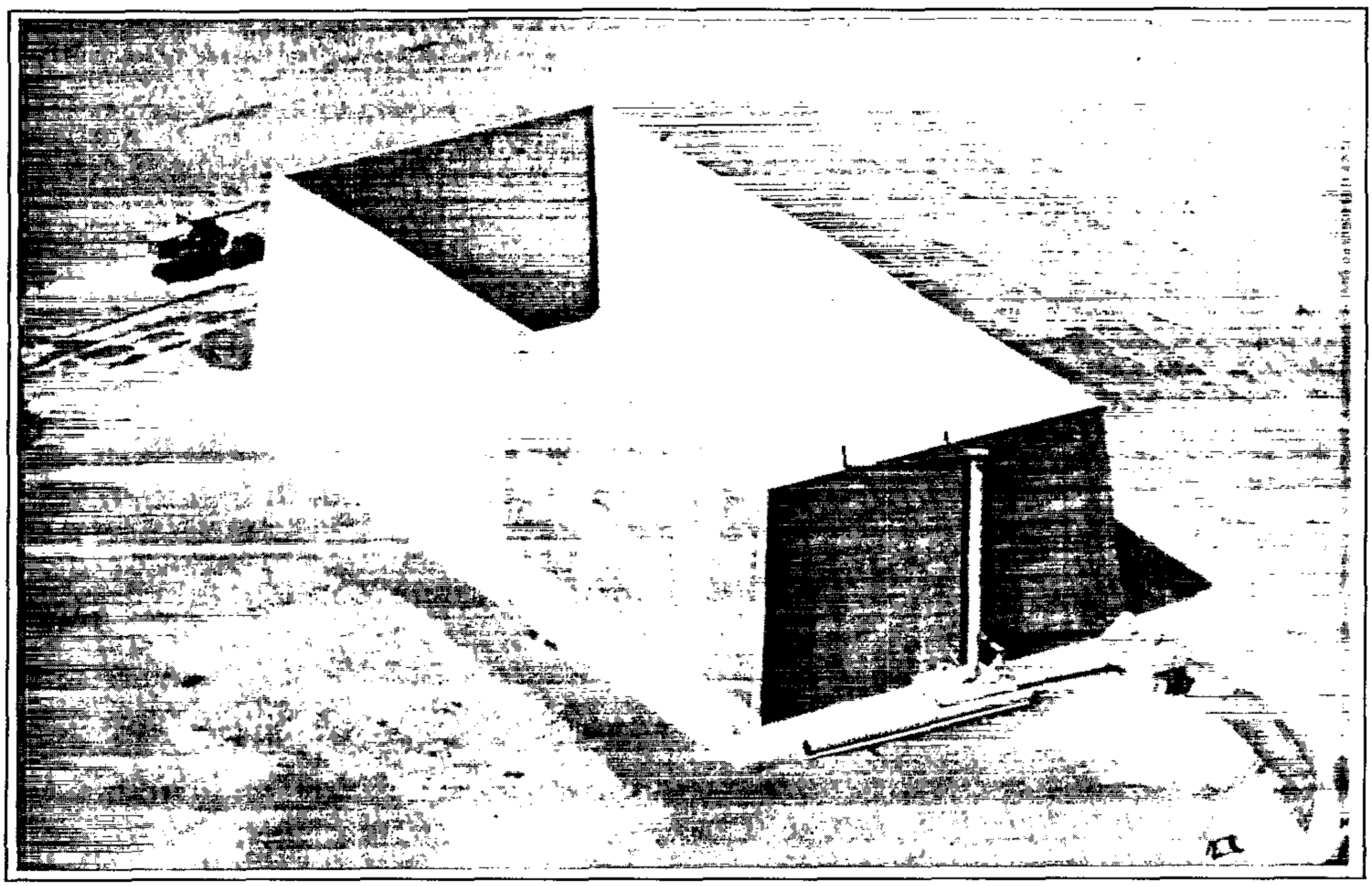
Grout Treatment Facility



The Grout Treatment Facility consists of the Dry Materials Facility, processing equipment and disposal vaults. It solidifies low-level liquid waste in cement-based grout which is disposed of in buried vaults. The Grout Treatment Facility is scheduled to start operations in 1988 with a full scale demonstration. Grouting of the low-level portion of double-shell tank waste will follow, and be completed by the year 2014.

The vault design meets all the requirements established by the State of Washington and the U.S. Environmental Protection Agency for hazardous waste disposal, including a double-liner/leachate collection system. The grout process itself is being studied at the Oak Ridge National Laboratory in Tennessee and at the Pacific Northwest Laboratory at Hanford. Scientists are making samples of the waste with the same chemicals and radionuclides as Hanford waste and testing them to optimize the waste retention capability of the cement-like material.

Grout Vault Under Construction



This pnotograph shows the first of the grout vaults under construction. This vault will be used for demonstrating grouting technology in 1988 and 1989.

Double-Shell Tank Waste (continued)

Once the double-shell tanks are emptied and are no longer needed, they will be filled with material to prevent long-term settlement of the overlying soil due to eventual structural failure and collapse of the tanks. A protective barrier and marker system will be placed over the filled tanks to prevent wind erosion and water infiltration, as well as plant, animal, and human intrusion. Similar barriers will be placed over the grout vaults.

The work is well defined in the area of double-shell tank waste disposal and the DOE is proceeding with the design of these facilities, including the modifications to the pretreatment facility where the wastes will be separated if necessary. Some technical items are being finalized now that the Record of Decision is issued. One is characterization of the double-shell tank wastes. This is necessary in order to optimize waste-specific retrieval, pretreatment and immobilization techniques.

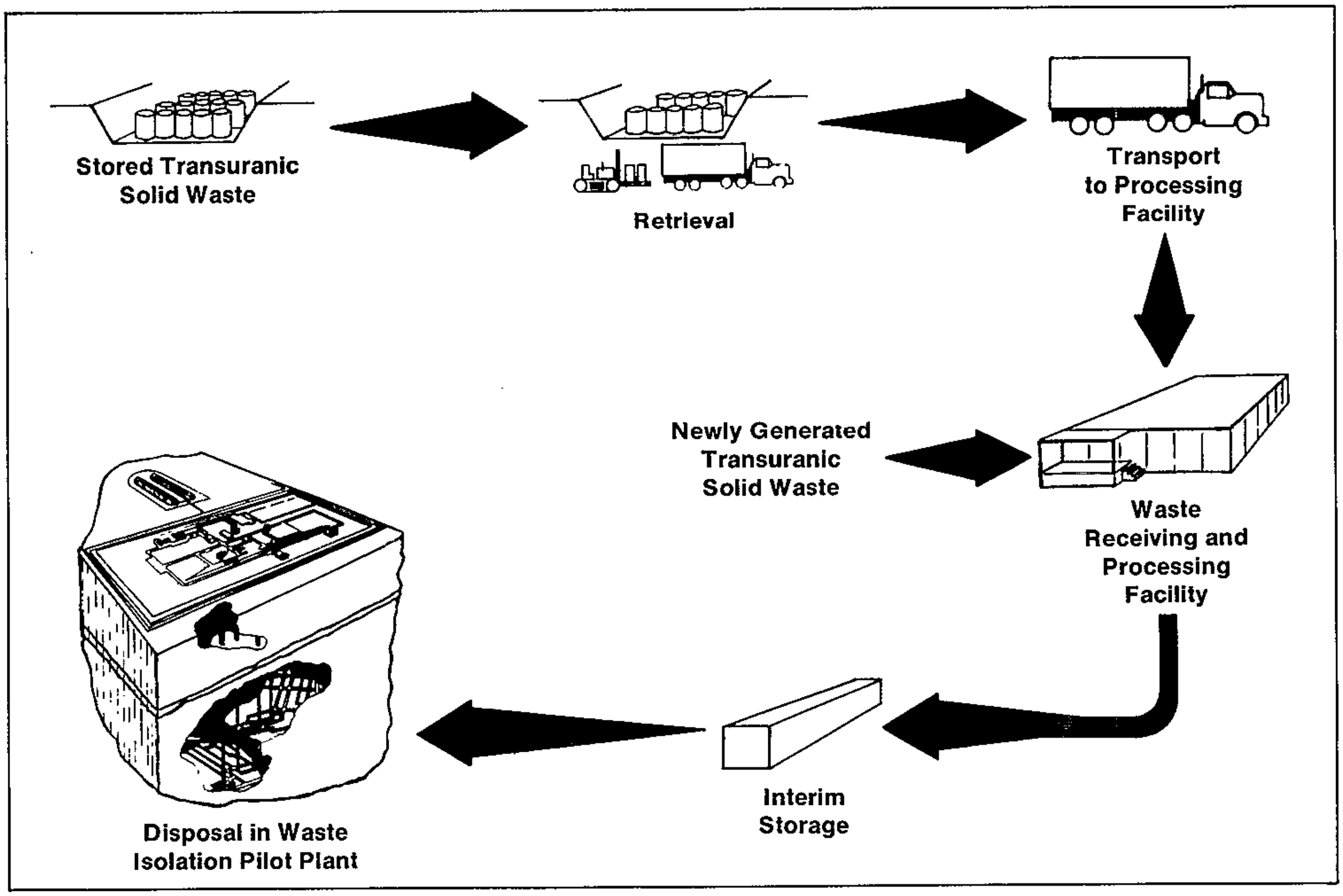
For double-shell tank waste, disposal is estimated to cost $2.6 billion over a 28 year period which will end in approximately the year 2016. This schedule includes 2 years after completion of vitrification and grouting activities to complete the installation of the protective barrier and marker system for the grout vaults and tanks. The cost and schedule estimates for disposal of double-shell tank wastes do not reflect the decision to place the N Reactor in cold standby, announced in February 1988. The principal effect of this decision on disposal activities described in this plan would be to reduce the volume of future double-shell tank wastes, thereby producing fewer canisters of vitrified high-level waste and fewer grout disposal vaults than the numbers stated in this plan. This would result in earlier completion of disposal of double-shell tank wastes, and at a lower cost, than would have been the case had N Reactor been operated through the mid 1990's, as previously planned.

Stored and Newly Generated Transuranic Solid Wastes

The solid transuranic waste which has been stored at Hanford since 1970 will be packaged and sent to a special geologic repository which is being built near Carlsbad, New Mexico. This facility, referred to as the Waste Isolation Pilot Plant (WIPP), is specifically designated for disposal of defense transuranic waste. Some of the transuranic solid waste generated since 1985 is certified and stored for shipment. Once WIPP is ready to accept waste, currently scheduled for 1989, shipments of newly generated transuranic solid waste will begin.

The shipping container used will meet Department of Transportation and Nuclear Regulatory Commission requirements. It is being designed and built by a private firm under another DOE contract. As presently envisioned, it will hold fourteen 55-gallon drums or equal volume of fabricated metal boxes. Three shipping containers would be transported together by truck. Once it has been designed, built and tested, this truck-mounted shipping container will routinely be used to transport wastes from those DOE defense sites which generate transuranic wastes to the WIPP.

Transuranic Solid Waste Disposal



For stored and newly generated transuranic solid waste, the DOE has decided to initiate shipments of newly generated waste to the Waste Isolation Pilot Plant (WIPP) and construct a treatment facility (WRAP) to process and package stored waste for disposal. The low-level waste resulting from the WRAP treatment will be sent to disposal sites at Hanford.

Stored and Newly Generated Transuranic Solid Wastes (continued)

Previously stored transuranic waste may need some repackaging and/or pretreatment prior to shipment. This is because when the waste was originally stored, the specific waste acceptance requirements for the repository had not been defined. The Waste Receiving and Processing Facility (WRAP) will inspect, sort, repackage, pretreat if necessary, certify, and prepare the waste for shipment to the WIPP. Those wastes not immediately certifiable will be shredded, immobilized (using grout) and placed in new 55-gallon drums to assure compliance with the WIPP waste acceptance criteria.

As the design progresses on the WRAP facility, work will focus on the following areas:

Nondestructive assay and examination — Since the waste consists primarily of paper, failed equipment and laboratory refuse, it is difficult to detect the low levels of radioactivity. Methods called non-destructive assay and examination, which can do this rapidly and accurately, have been developed at Los Alamos National Laboratory in New Mexico. Advanced computer-controlled technology that will eliminate the need to open the drums and boxes will be used.

Retrieval — Retrieval equipment for wastes stored since 1970 will be designed to minimize human contact, handling, and airborne contamination.

Processing/packaging — Commercially available shredders and compactors will be evaluated for use in the WRAP facility. Care is being taken to ensure the disposal criteria are fully met with the waste presently being packaged so no repackaging will be necessary.

Current plans show transuranic waste treatment at WRAP starting in 1999 and continuing until 2013. The current plan for shipment includes certifying the waste and packaging it in 55-gallon drums, and occasionally in metal boxes, and shipping these by truck-mounted shipping containers on established routes. About 2,500 shipments will take place between 1989 and 2013.

Until the WRAP facility is operational, transuranic content is being verified in the Transuranic Storage and Assay Facility. The Transuranic Storage and Assay Facility is located in an existing building at Hanford. Newly generated wastes that have a low level of radioactivity (referred to as contact-handled transuranic wastes) have been stored there since 1985. Newly generated transuranic waste will go directly to the WIPP if the waste has been packaged in compliance with WIPP waste acceptance criteria. If not, it will be directed to the WRAP facility for processing. Certified transuranic waste that is stored in the Transuranic Storage and Assay Facility may be shipped to the WIPP as early as 1989.

When the small portion of transuranic waste which also has a high radioactivity (referred to as remote-handled transuranic wastes) is recovered, special handling and packaging will be required. Special handling and packaging will also be required for the one pre-1970 site not located on the central plateau. The design for special handling and packaging of remote-handled transuranic waste will be completed after the year 2000.

The total projected cost for disposing of retrievably-stored and newly-generated transuranic solid waste is $190 million, concluding in 2013. This includes $46 million in capital costs for the WRAP facility.

Encapsulated Cesium and Strontium Waste

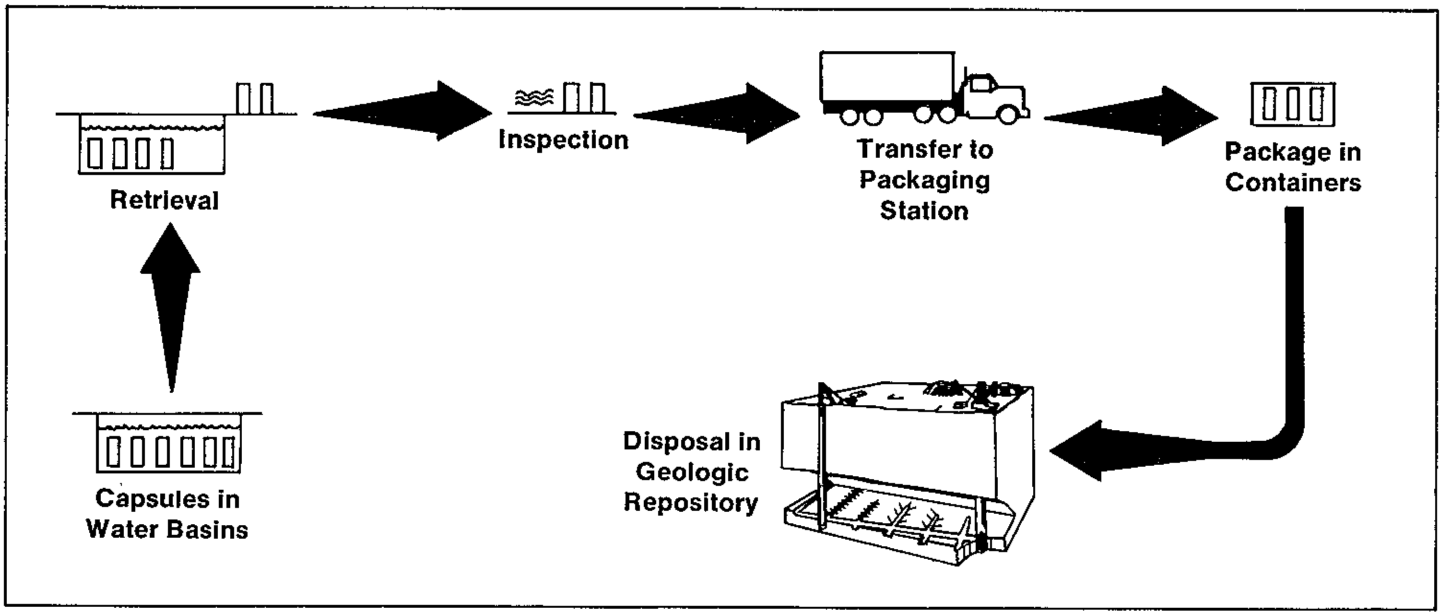
The preterred plan for the disposal of encapsulated cesium and strontium waste is to package the capsules in canisters and ship them to the geologic repository. This would involve:

- Modifying the Waste Encapsulation and Storage Facility or building a new facility to support packaging activities;
- Removing the capsules from the water basins where they are stored, inspecting and packaging them into canisters; and
- Shipping them to the geologic repository for disposal.

The radioactive cesium and strontium are currently in the form of crystalline salts of cesium chloride and strontium fluoride. Additional processes may be required to modify the current form depending on the waste acceptance criteria developed for the geologic repository. Design work for facility modifications or additions will not start until detailed waste acceptance criteria are developed.

The total projected cost for encapsulated strontium and cesium waste disposal is $210 million, concluding in 2010.

Capsule Disposal



For encapsulated cesium and strontium waste, the DOE will package the waste for shipment and disposal in a geologic repository. This action will be delayed for approximately 20 years as nearly half of the capsules are being used as radiation sources for sterilization of medical supplies, disinfestation of food, or other beneficial purposes. The capsules that are not being used are stored and monitored in water basins at Hanford.

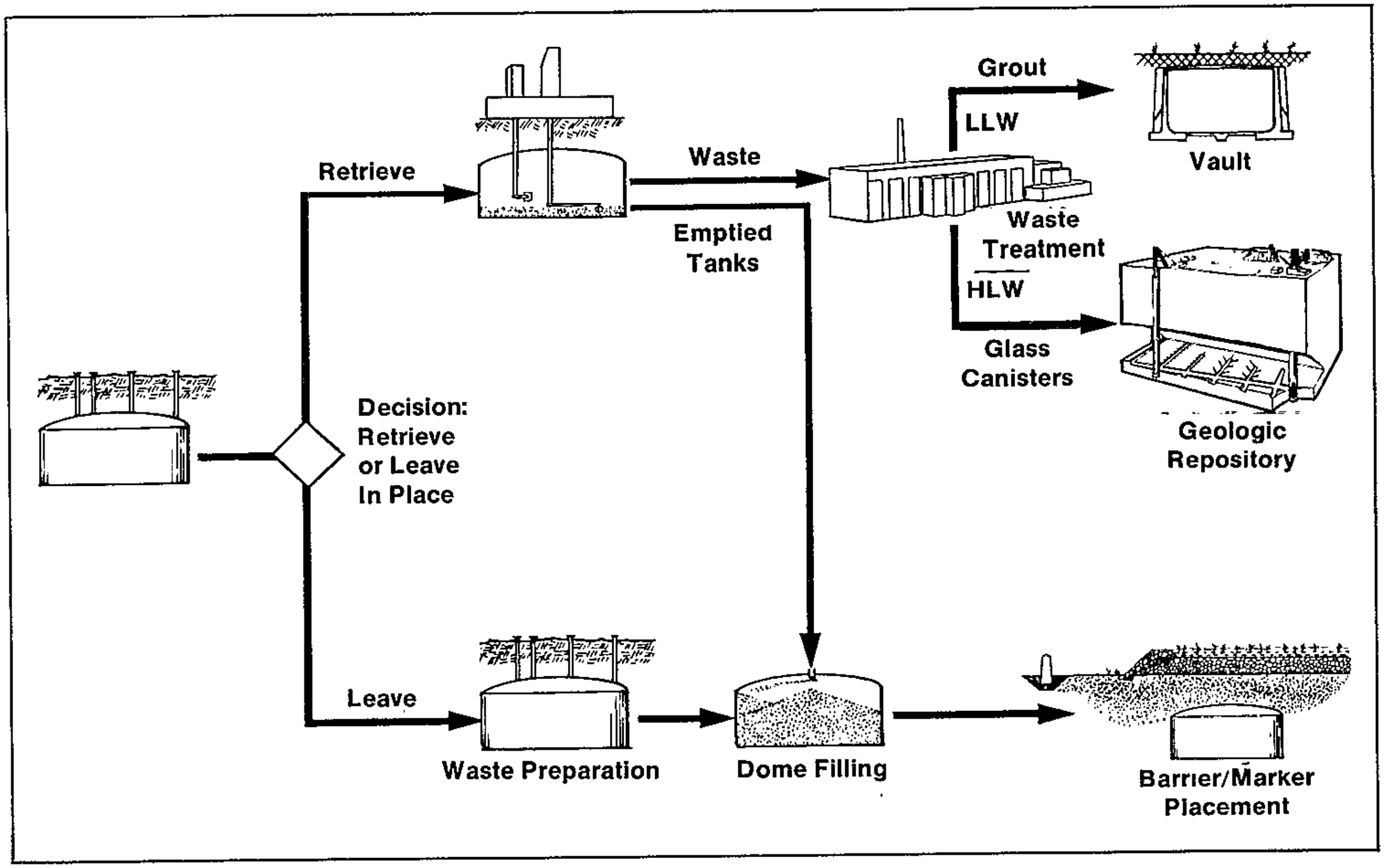
Single-Shell Tank Wastes

For single-shell tank waste, DOE will continue present waste management practices while conducting additional development and evaluation to support final disposal decisions. A supplemental Environmental Impact Statement on alternatives for disposal of these wastes will be prepared and issued for public and governmental agency review prior to making any final disposal decisions. In addition to the Atomic Energy Act (AEA) requirements for radioactive waste, the Resource Conservation and Recovery Act (RCRA) closure requirements will be addressed to ensure that the hazardous constituents of single-shell tank waste are properly considered when selecting a disposal option.

Technology development and evaluation activities for single-shell tank wastes include:

Characterization — Numerous waste transfers have been made between single-shell tanks, involving a wide variety of wastes. Also, some hazardous chemicals have been used during processing of the spent fuel. More information is needed, particularly on the hazardous chemicals present, before specific disposal decisions can be made. Processing records have been extensively reviewed, and some samples of the waste have been taken. More samples need to be gathered and analyzed so that the risks associated with the tanks

Single-Shell Tank Waste Disposal Alternatives



For single-shell tank waste, further development and evaluation will be conducted before final disposal decisions are made. This development and evaluation will consider waste characterization, waste retrieval techniques, and other technical issues associated with either leaving or retrieving the waste. Before final decisions are made, a supplemental EIS will be prepared and issued for public and governmental agency review and comment.

can be evaluated. More efficient sampling methods are being evaluated. This work has been underway for several years.

Retrieval — Methods for retrieving wastes from the tanks need further development and evaluation. Of the several retrieval concepts, the most promising ones will be optimized for efficiency of waste removal and tested.

Removal methods must be carefully selected because some of the tanks have leaked. For instance, sluicing with liquid could cause some leakage of waste into the surrounding soil. A dry-mining technique, in contrast, is slower and may require greater worker exposure to the wastes.

Pretreatment of retrieved waste — The waste retrieved from single-shell tanks would need to be treated before it is immobilized. This would keep the volume of waste needing to go to a geologic repository to a minimum and ensure the low-level waste left near-surface would meet regulatory limits for radioactive and hazardous chemical components. Many of the processes being developed for pretreatment of double-shell tank wastes could be adapted to single-shell tank waste, as could processes being developed at the Savannah River Plant in South Carolina and at Argonne National Laboratory in Illinois. One of these processes, called TRUEX (for transuranic extraction), shows great promise in being able to effectively separate out several long-lived radionuclides that require permanent isolation, thus greatly reducing the number of waste canisters needing to go to a geologic repository.

Heat management — Some types of single-shell tank waste generate large amounts of heat because of radioactive decay. If disposed of in-place the methods of isolating the waste could cause an insulating effect that, combined with the radioactive decay, could cause an unacceptable overall temperature increase.

Chemical effects — Certain organic chemicals could affect the stability and increase the mobility of the wastes. Several types of organic chemicals are in single-shell tanks in varying amounts. Acceptable levels of chemicals in tanks can be established based on waste mobility, ability of the final disposal design to contain the waste, and environmental regulations. If necessary, methods will be developed to destroy the organic chemicals by treatment in the tanks, or during waste recovery.

Moisture effects — Excessive moisture could make the wastes more mobile. The need to draw off excess moisture will be determined and, if required, drying technology will be developed and demonstrated. The current program of using special pumps to remove liquids trapped in the waste is efficient for removing large quantities of liquids, but may not be sufficient if the waste must be made very dry.

Dome fill — Whether the waste is removed or not, the empty space under the tank dome must eventually be filled to prevent potential dome collapse. If the tanks were not filled, the effectiveness of the surface protective barrier could be reduced. Technology developed to fill the tanks focuses on materials to be used (e.g., gravel, clay, sand) and installation methods and equipment.

Much work has been done on the development and testing of dome filling equipment. A preliminary evaluation of rock materials was performed, with crushed basalt chosen, since it met all criteria and is readily available at Hanford. A waste tank mock-up facility was used to test equipment considered for filling the tanks.

Single-Shell Tank Waste (continued)

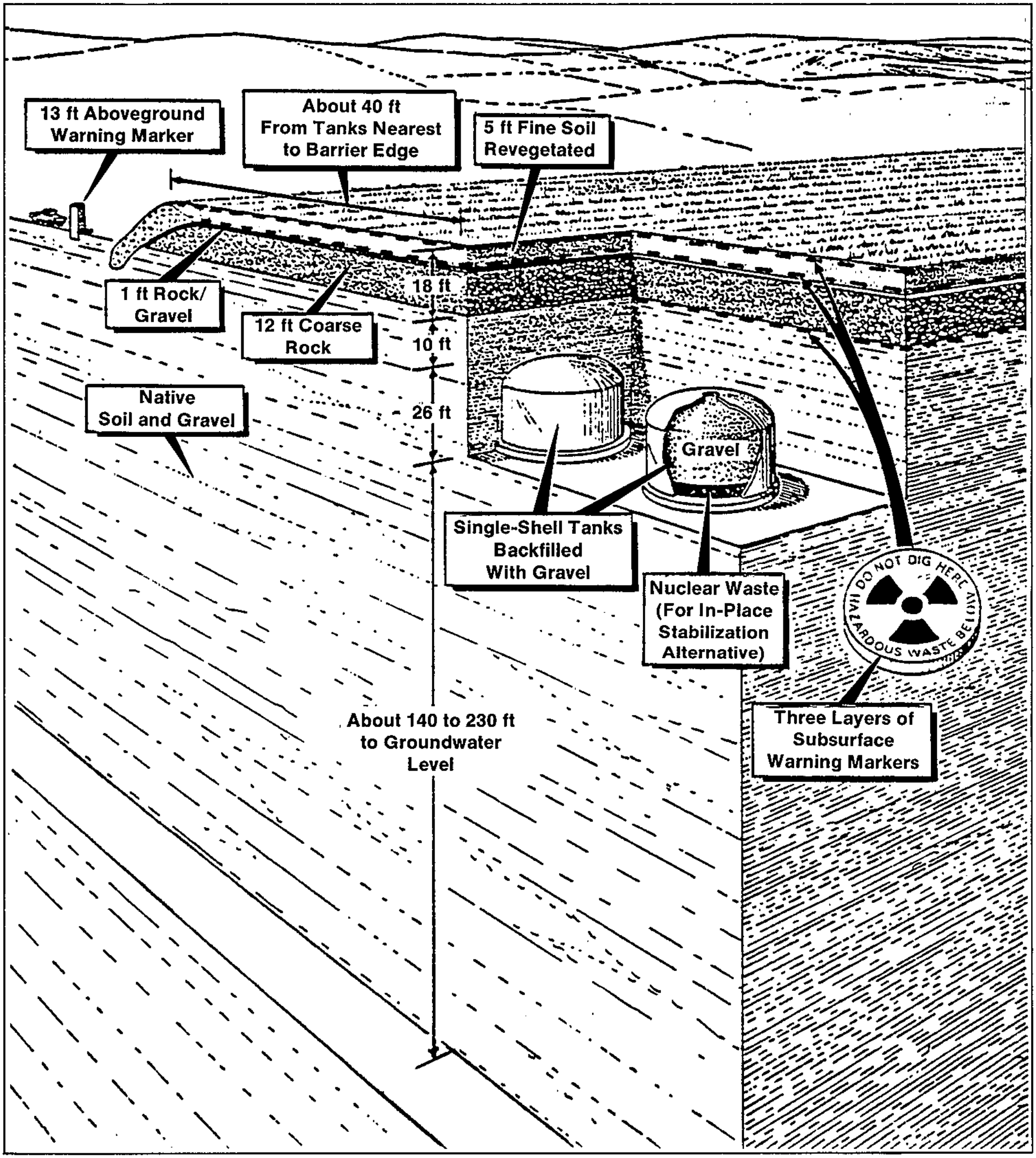
Protective barriers — Protective barriers will be placed over waste disposal sites to control potential movement of wastes and radiation exposure to inadvertent intruders. This is an essential part of the permanent disposal of wastes buried near the surface, potentially including single-shell tank wastes. It is intended that access to waste disposal sites be controlled indefinitely. However, the barrier is being designed so that future generations will be protected even though active monitoring, maintenance, or government controls may not be in place.

These protective barriers are being developed at Hanford to prevent or reduce the likelihood of wind erosion, water infiltration, and plant, animal and human intrusion. Scientists are developing a barrier that will continue working for 10,000 years and longer, despite possible earthquakes, high winds, and floods. Barrier designs have been developed and are presently being tested and evaluated to determine their effectiveness.

Markers — Markers to identify the area as a waste site are being developed. Among the questions to be answered are which disposal sites need what kind of marker, what the marker will be made of, what it will look like and what it will say. Markers developed to date have been tested for resistance to the elements and cost estimates prepared.

For single-shell tank waste, enough information should be available to recommend final disposal alternatives by the late 1990's. A supplement to the HDW-EIS will then be prepared, and will be available for public and governmental agency review. The development and evaluation will extend to the year 2015 to support vitrification and grouting of retrieved tank wastes. If it is decided that single-shell tank wastes will be stabilized in place, development and evaluation activities could be completed sooner.

The Conceptual Protective Barrier and Marker System



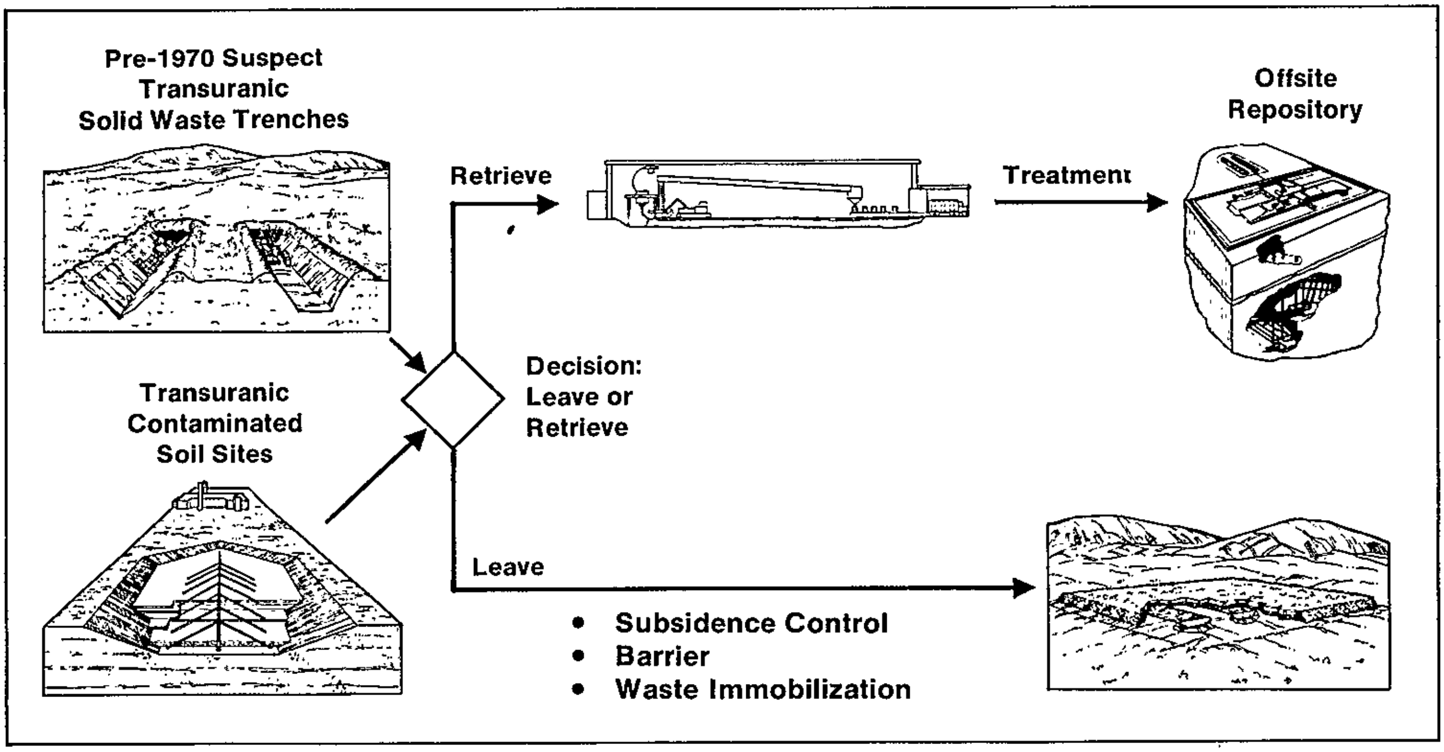
The protective barrier and marker system prevents or reduces the likelihood of wind erosion, water infiltration, and plant, animal, and human intrusion. After studying and evaluating several concepts for a protective barrier system, a multilayered earthen cover shown here was chosen for extended evaluation and analysis.

Transuranic-Contaminated Soil Sites and Pre-1970 Buried Suspect Transuranic Contaminated Solid Waste

Present waste management practices will continue while conducting additional development and evaluation activities. These activities are needed before making final decisions on remediation of transuranic-contaminated soil sites and pre-1970 buried suspect transuranic-contaminated solid waste sites. The DOE is involved in discussions with the U.S. Evironmental Protection Agency (EPA) and the State of Washington Department of Ecology to ensure all the sites will be in compliance with applicable regulations. These sites are all suspected of containing hazardous materials, which makes them subject to the environmental regulations imposed by the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA—or "Superfund") and the Superfund Amendments and Reauthorization Act (SARA).

Development and evaluation activities for these wastes are listed below. Very similar studies are being performed under CERCLA for the non-transuranic inactive waste sites; hence studies for the transuranic-contaminated sites and the non-transuranic inactive waste sites are being combined to ensure consistency of approach. Priorities for characterization and remedial actions for transuranic-contaminated sites will be established relative to all CERCLA sites.

Disposal Alternatives for Transuranic Contaminated Sites



For transuranic contaminated soil sites and pre-1970 buried suspect transuranic solid waste, further development and evaluation will be conducted before final disposal decisions are made. This work will be done under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). Public and governmental agency comments will be sought on follow-on environmental documentation.

Characterization — The sites will be characterized to:

- Confirm the existence and amount of transuranic, low-level, or hazardous waste;
- Estimate the potential for waste movement and provide data for developing cost-effective stabilization if the waste is to be left in place;
- Support safety analyses and assessments of disposal system long-term performance; and
- Comply with applicable regulations.

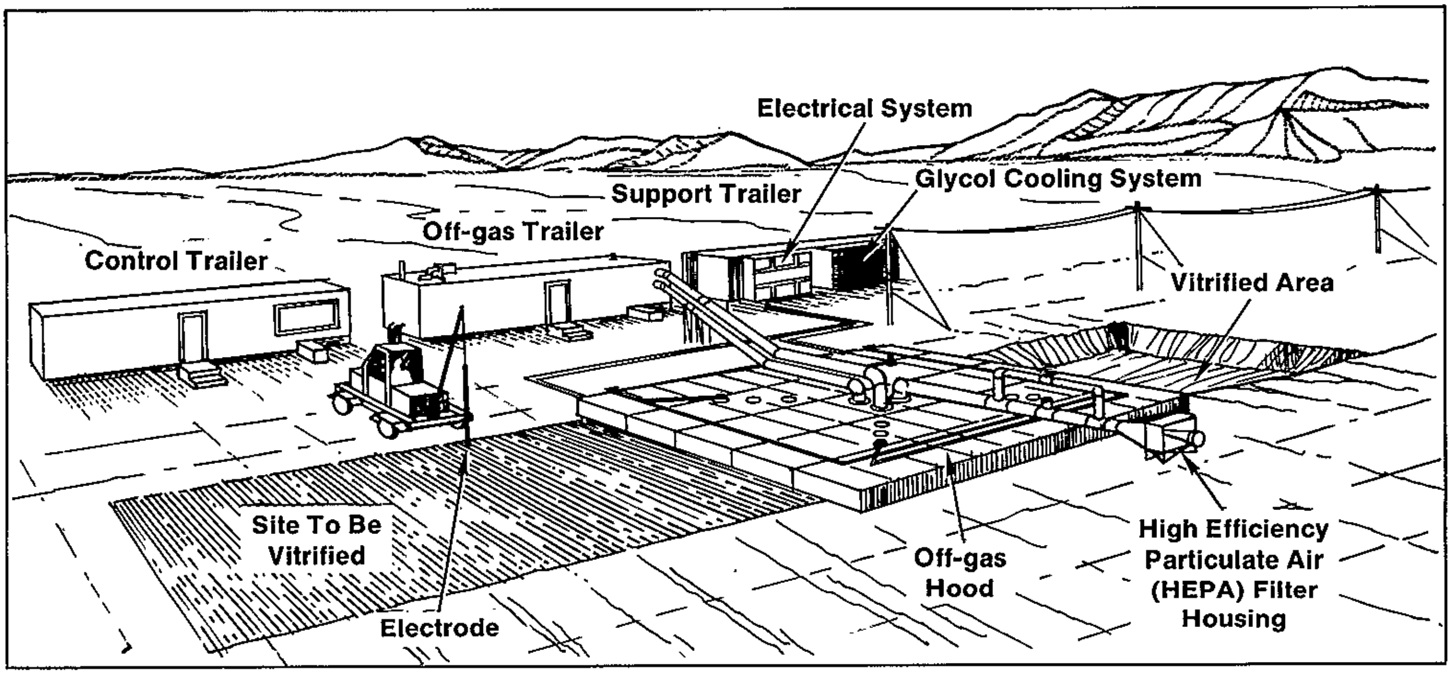
Subsidence control — This is needed to prevent settling of the soil above partially filled drums, boxes and underground structures that may collapse. Methods for prevention and control of settling are being developed. Methods being studied include filling the waste container voids with various materials such as grout so the container will be supported, or compacting the waste containers in place.

Waste immobilization — Some waste may need to be immobilized in place. The methods to do this need to be determined and tested. Both grout injection and in situ vitrification techniques would be studied.

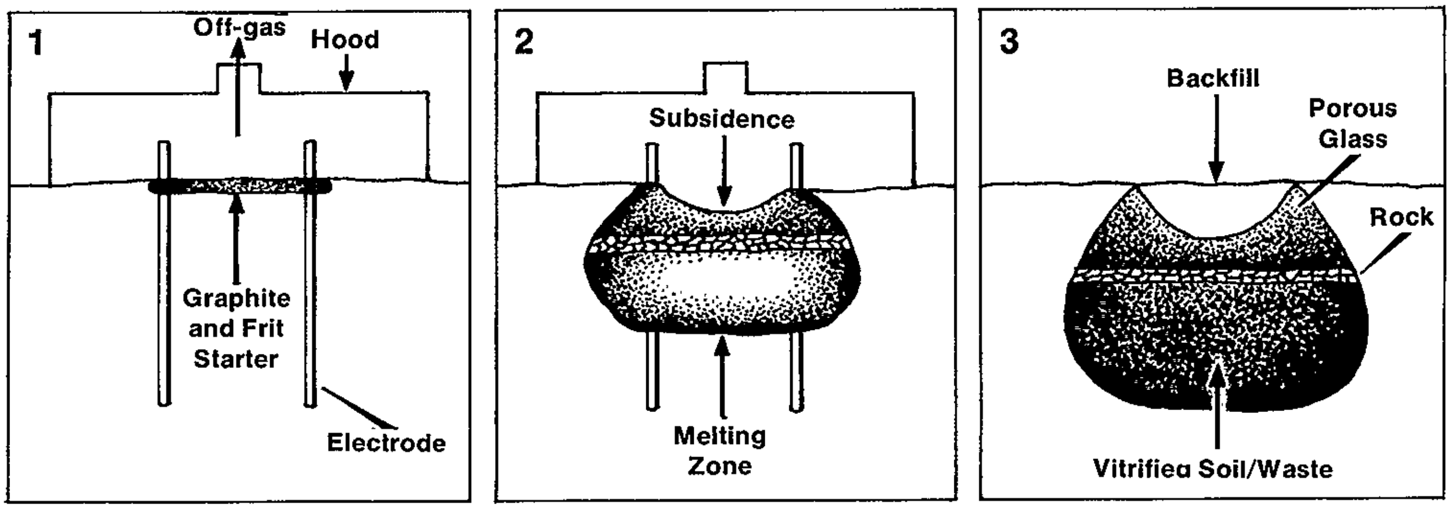
Grout injection works by pumping a grout slurry into and around the wastes. The wastes contain voids which would be filled with the grout. This would help stabilize the waste in place.

In situ vitrification involves fusing contaminated buried waste into an immobile glass and crystalline form with electrical current. This technology is an outgrowth of earlier waste immobilization studies. It was conceived in 1980 and many tests have since been done, including pilot-plant scale and large scale tests. A full-scale demonstration of the technology was conducted in June 1987 at an actual contaminated soil site at Hanford. Characterization of the demonstration is scheduled to begin during the summer of 1988.

In-Situ Vitrification



Operating Sequence



In situ vitrification is a process being developed by Pacific Northwest Laboratory for the Department of Energy to stabilize in place radioactive or hazardous wastes. A full-scale demonstration of this technology for stabilization of transuranic contaminated soil was conducted in June 1987. Characterization planned to begin in 1988 will evaluate the success of this approach in immobilizing transuranic elements.

Retrieval — If retrieval becomes necessary, retrieval methods would need to be developed.

In the 1970's, one transuranic-contaminated soil site was partially retrieved. A structural hood was built over the trench and several feet of soil removed from the trench. This method, though expensive, could be used at some of the sites. Because the depth and physical characteristics vary from site to site, one method may not be enough. Methods of reducing the cost while maintaining a high degree of safety would be evaluated.

Processing of retrieved waste — Any retrieved waste must be processed to meet waste form disposal criteria for WIPP or other geologic repository, to reduce the volume requiring geologic disposal, and to comply with environmental regulations for any low-level portions of the retrieved waste which may be disposed of by shallow land burial at the Hanford site. Use of the WRAP facility to sort, process and package the transuranic-contaminated soil or pre-1970 transuranic solid waste will be evaluated. Modifications, as necessary, will be defined.

Protective barriers and markers — These development and evaluation tasks are the same ones as for single-shell tank wastes.

After the development and evaluation program is completed, an environmental impact analysis will be performed and used as a basis to determine whether these disposal impacts significantly exceed the impacts in the HDW-EIS. This analysis will be publicly available prior to making a final decision on these wastes.

Determination of the order in which the sites will be characterized and final remedial action implemented will be done in accordance with the CERCLA process, which provides for public input during the evaluation and planning phase. Enough information should exist to start recommending final remedial action alternatives in the mid-1990's for these waste sites.

The development and evaluation period will extend through the year 2004 to support final decisions on retrieval and processing of transuranic contaminated soil and buried solid waste. If it is decided that these wastes will be stabilized in place, rather than retrieved and treated for disposal, then development and evaluation activities could be completed sooner.

U.S. Department of Energy
Richland Operations
June 1988

Notes: